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INTRODUCTION TO WEB TECHNOLOGIES

Web Tech
SET08101

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TL/DR

- Before we can go anywhere, we should really know how we got here.

- A potted history of the Internet, Web, Hypertext, DOM, & Basic Web Architecture (Servers & Clients)

- What happened technologically & socially, that lead to the situation we are in now?

- Overview of the basic things we need to know to understand how it all fits together

AIMS

- At the end of this (sub-section) of the topic you will be able to:
  - Understand the variety of technologies, tools, languages, and protocols that make up the web

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COMMUNICATION

- Protocols are agreements for how to communicate
- Computer protocols are agreements are specified with enough clarity that a computer can follow them
- The Internet & web are really just communication methods (protocols) - agreements for how two machines can exchange information

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THE INTERNET

- A global system of interconnected computer networks
- Built on shared & agreed protocols - the Internet Protocol suite (TCP/IP)
- Dates back to research in the 1960's commissions by the US government that aimed to build robust, fault tolerant communication via computer networks
- WWW is just one information resource/service that communicates using the Internet (although people often use the terms interchangeably)

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INTERNET PROTOCOLS

- **Application Layer:** DNS, HTTP, IMAP, POP
- **Transport Layer:** TCP
- **Internet Layer:** IP
- **Link Layer:** Ethernet

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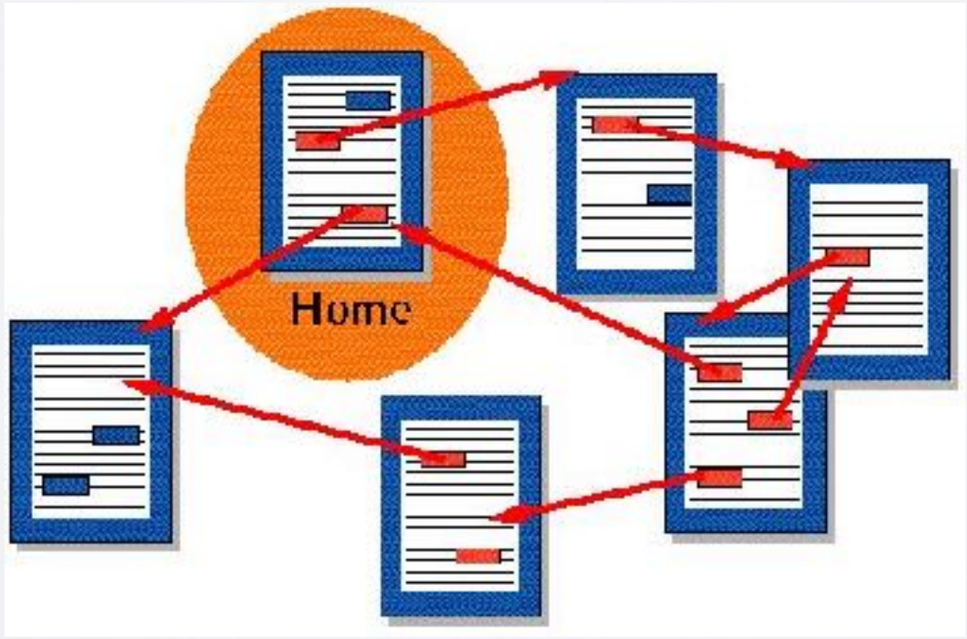
INVENTION OF THE WEB

- Invented in 1989 by Tim Berners-Lee
- First web browser written in 1990
- Originally seen as a way to share scientific research, e.g. amongst physicists. Obviously we've come a way since then.
- Initially formatted text only, rapidly moved to support images, audio, video, and other media types.
- Is an implementation of a quite old idea called *hypertext*
- The history of the web is really the story of how various interests have tried to exploit that original formatted text idea.

HYPERTEXT

- Term coined by Ted Nelson in ~1965 - part of a model for linked content - as part of project Xanadu
- Text displayed on an electronic device that incorporates references, called Hyper-Links, to other text.
- Hyperlinks can be followed or navigated immediately.
- Text becomes *non-linear* as a result.
- NB. Doesn't always refer solely to text so hypertext and hypermedia are often used interchangably.
- One implementation of hypertext ideas is HTML



HYPERTEXT

- Vannevar Bush (1945) "As We May Think".
  - Introduced the Memex (*portmanteau of Memory & Index*).
  - A theoretical proto-hypertext device which inspired subsequent hypertext systems.
  - An enlarged intimate supplement to one's memory.
- Douglas Engelbart (1962) "The Mother of all Demos"
  - Demonstrated a hypertext interface to the public for the first time
  - Also demonstrated many other fundamental features of modern personal computing systems:
    - windows, hypertext, graphics, efficient navigation and command input, video conferencing, the computer mouse, word processing, dynamic file linking, revision control, and a collaborative real-time editor (collaborative work)
  - Available on various streaming sites, e.g. YouTube, search "The Mother of all Demos"

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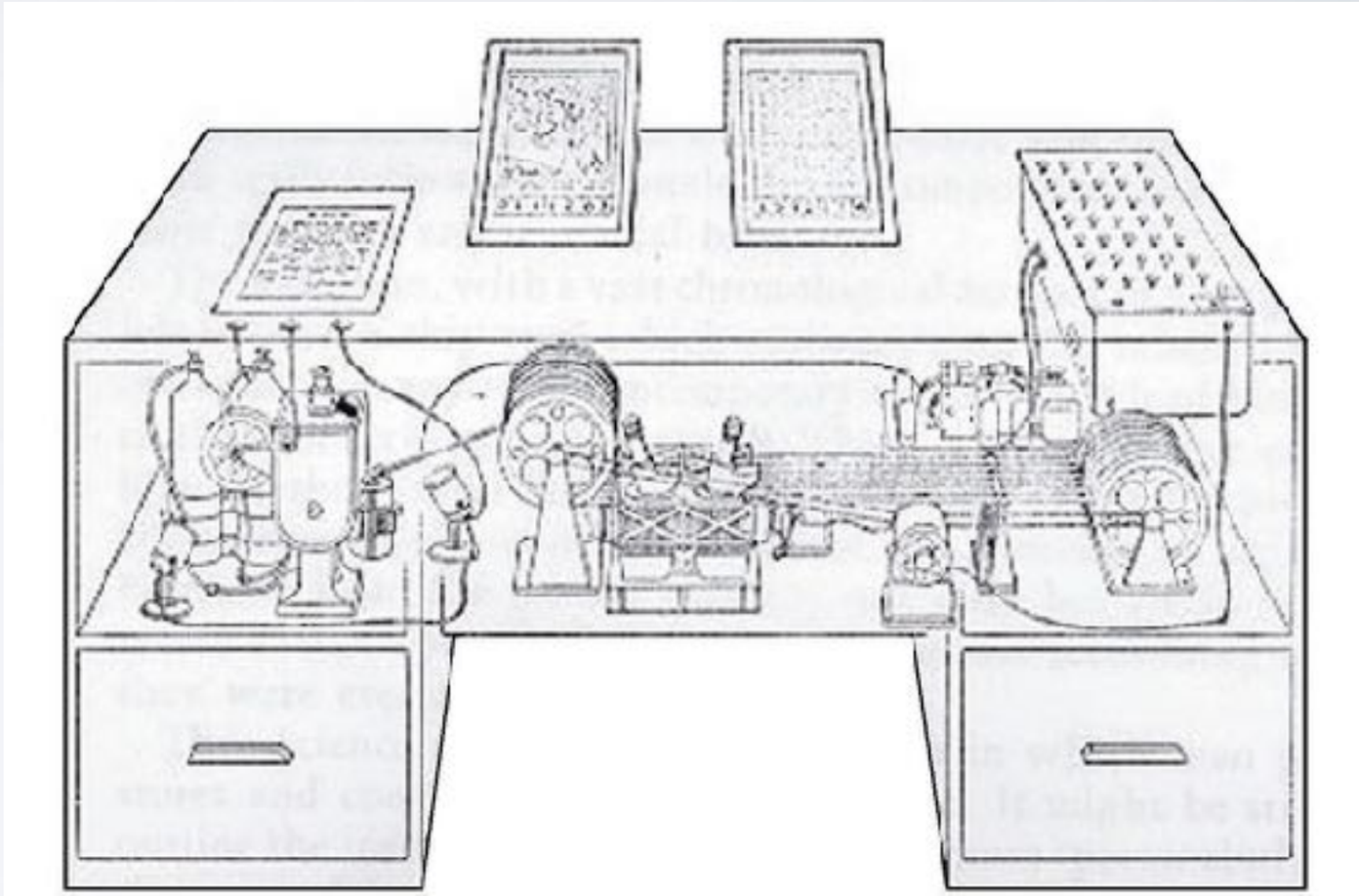
MEMEX

- Store & record content on reels of microfilm.

- Microfilm content indexed using coded symbols recorded next to individual microfilm frames.

- Electric photocells read coded symbols as reel spun at high speed & stopped on command.



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HTML

- **H**yper**T**ext **M**arkup **L**anguage
- A **language** for turning **text** into **hypertext** using **markup**
    - **Text** - strings (sequences of characters) encoded using an agreed format (Generally UTF8)
    - **Language** - Means for communication.
        - Many kinds of language, e.g. natural (e.g. English) & artificial (e.g. programming like Python or Javascript)
        - Usually some degree of agreement over the elements of the language, how they relate, and their meaning
    - **Hypertext** - Links between text
    - **Markup** - Many ways to do markup, not specific to HTML. HTML uses Tags, generally placed around the element being tagged, e.g.

<h1>Hello</h1>

- Explore the Mozilla Developer Docs to find out more

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SERVERS

- A piece of software that runs on a computer
- Listens for messages & calculates the right response to make
- A server is a piece of software that uses a particular protocol
  - We'll assume a server running on an Internet connected machine (TCP/IP)
  - A web server listens for messages that are sent using web protocols (HTTP)
- *If a server is listening then what is doing the speaking?*

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HTTP

- An application protocol for distributed and collaborative hypermedia systems.
- Request-response protocol that uses the client-server model.
- Client (browser) makes a request. HTTP server (software running on an Internet connected computer) listens and responds according to the protocol.
- Server stores resources and returns a response that may include providing access to those resources
- HTTP Session - a sequence of request-response transaction transmitted over TCP. Connects to a specific port (usually 80, sometimes 8080) on an IP address. HTTP server listens on that port
- Request Methods: HTTP verbs, e.g. GET, HEAD, POST, PUT, DELETE, OPTIONS, PATCH
- What is transmitted between client and server is just plain text.

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CLIENTS

- Another piece of software (nothing particularly special)
- Known as a user agent. The Browser is one but there are others:
  - web crawlers, voice browsers, mobile apps - any software that accesses, consumes, or displays web content.
- Sends messages from Internet connected machine (host) to a server
  - e..g a **web browser** making a **request** to a **web server** using **HTTP**

BROWSERS

- Software containing a layout engines that *renders* web pages (HTML)
- Also invested by Berners-Lee
- Used to navigate the web but also private networks, IoT interfaces, local file systems.

Desktop/laptop browser statistics

Google Chrome	62.09%
Mozilla Firefox	14.81%
Internet Explorer	9.62%
Safari	5.34%
Microsoft Edge	3.68%
Opera	1.6%
Yandex Browser	0.5%
Coc Coc	0.29%
UC Browser	0.24%
Chromium	0.18%
Sogou Explorer	0.16%
Maxthon	0.16%
360 Secure Browser	0.16%
QQ Browser	0.11%
Mozilla Suite	0.04%
Phantom	0.03%
Vivaldi	0.03%
Pale Moon	0.02%
Amigo	0.02%
SeaMonkey	0.02%
Other	0.06%

Desktop web browser market share according to StatCounter for February 2017.[19]

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BASIC WEB ARCHITECTURE

- The Client-Server Model
- Clients -software that communicate to a server by making **requests**
- Servers - software that **responds** to communications from clients
- NB. Can get (much) more complicated than that

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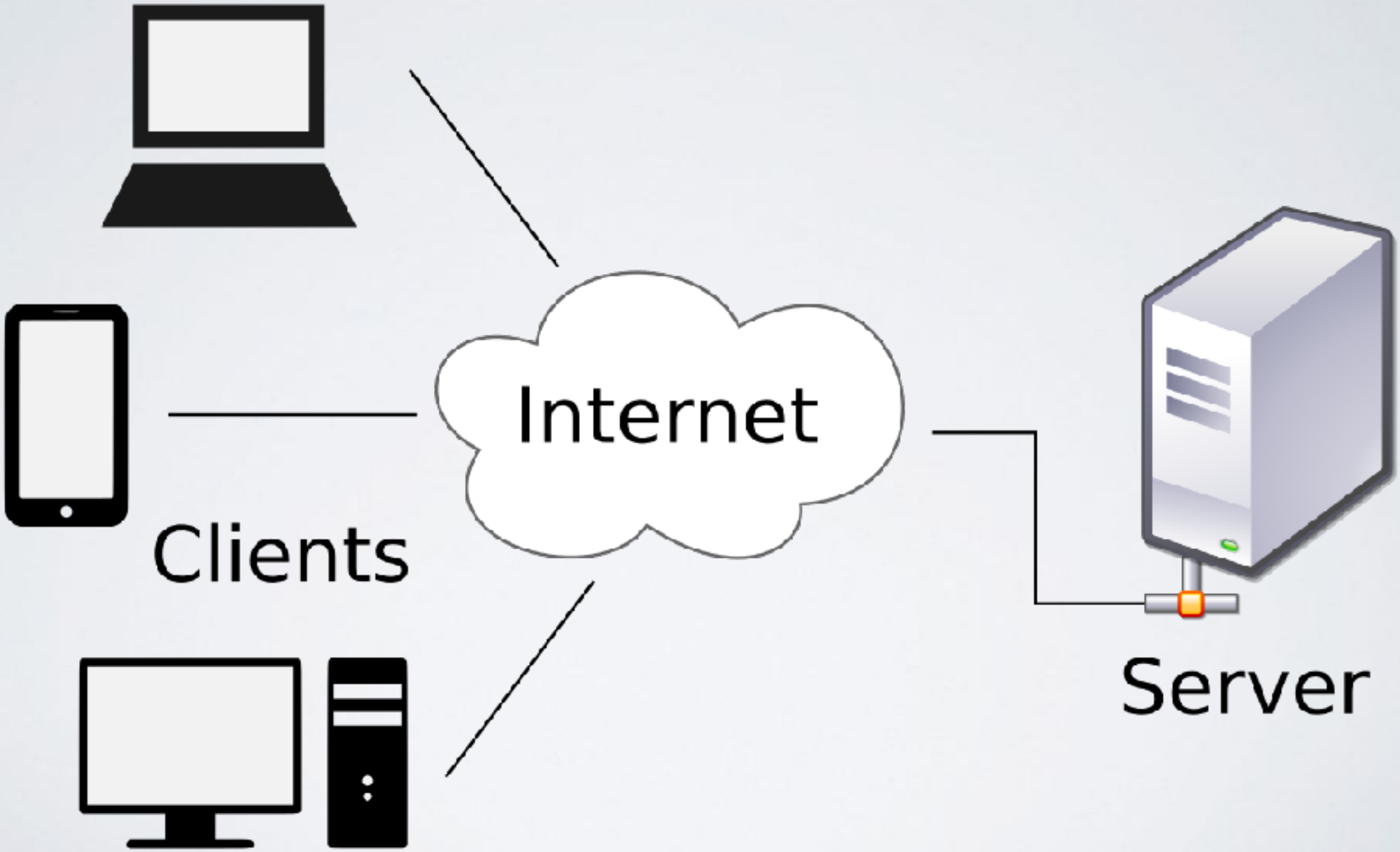
CLIENT-SERVER MODEL



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THE DOM

- **D**ocument **O**bject **M**odel
- A cross-platform, language independent API
- HTML is treated as a tree data structure within your browser.
- HTML is parsed into this data structure to construct the DOM (for that document)
  - Each node in the tree is an object representing part of the document
  - Objects can be manipulated programmatically, e.g. using Javascript, and the results displayed in the viewpane of the useragent (browser)
- What you see in view source is just the HTML
- HTML displayed in developer tools is a representation of the DOM

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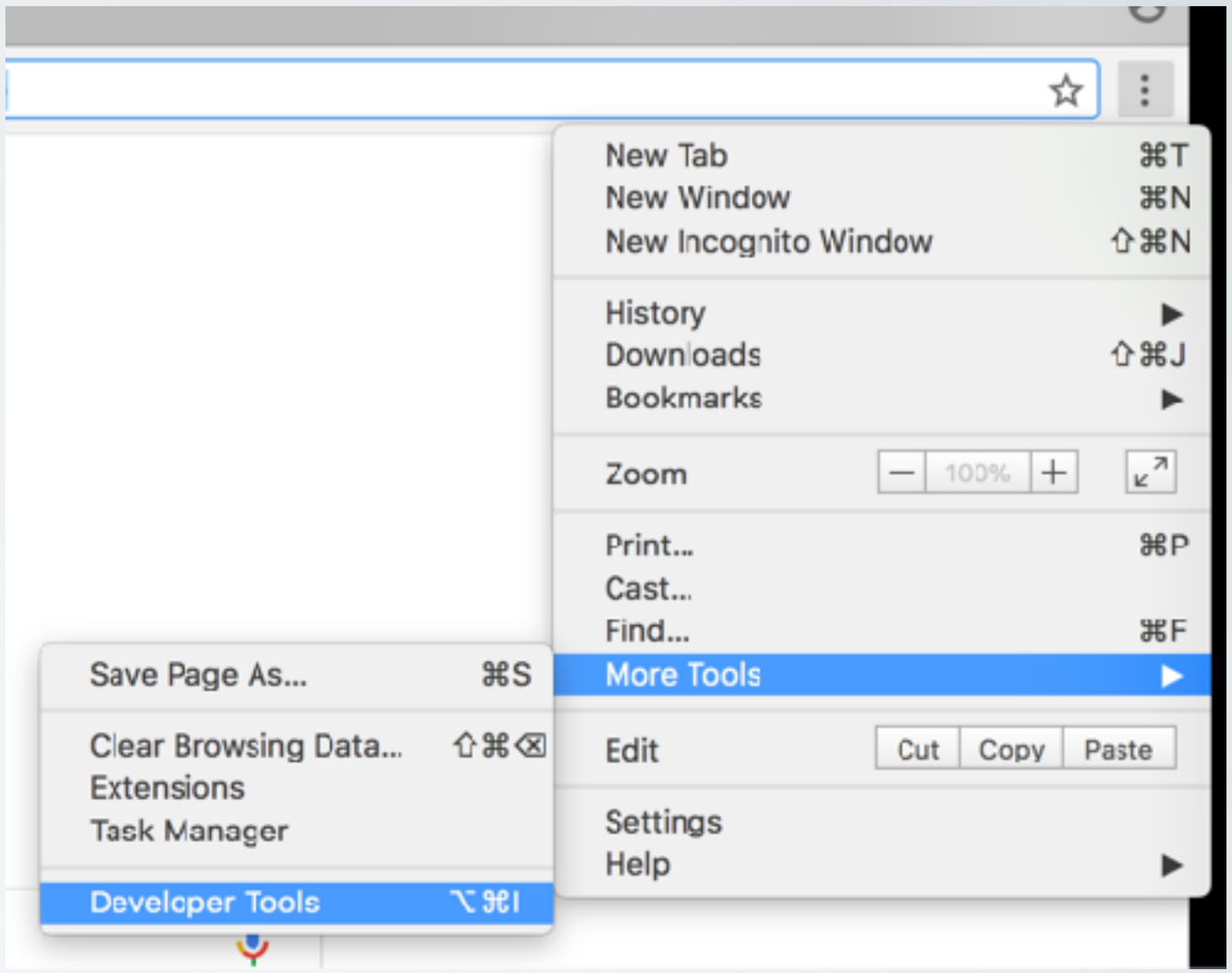
BROWSER DEVELOPER TOOLS

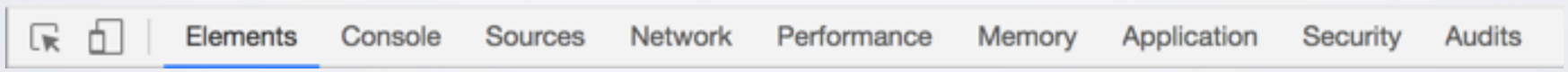
- Only really need a good editor and a good browser for client-side development - Web IDE's are overkill
- Browser: Chrome, Chromium, Firefox, Safari, Opera, IE/Edge
    - All newer browsers have support for some set of developer tools.
    - Chrome is a good default (but you should also test your sites across browsers)
- Common Features of Developer Tools:
    - HTML & DOM viewers & editors
    - Web page assets, resources, network information
    - Profiling & Auditing
    - JavaScript Debugging & Console
- Text Editors: Sublime, Notepad++, Atom, Brackets, Vim

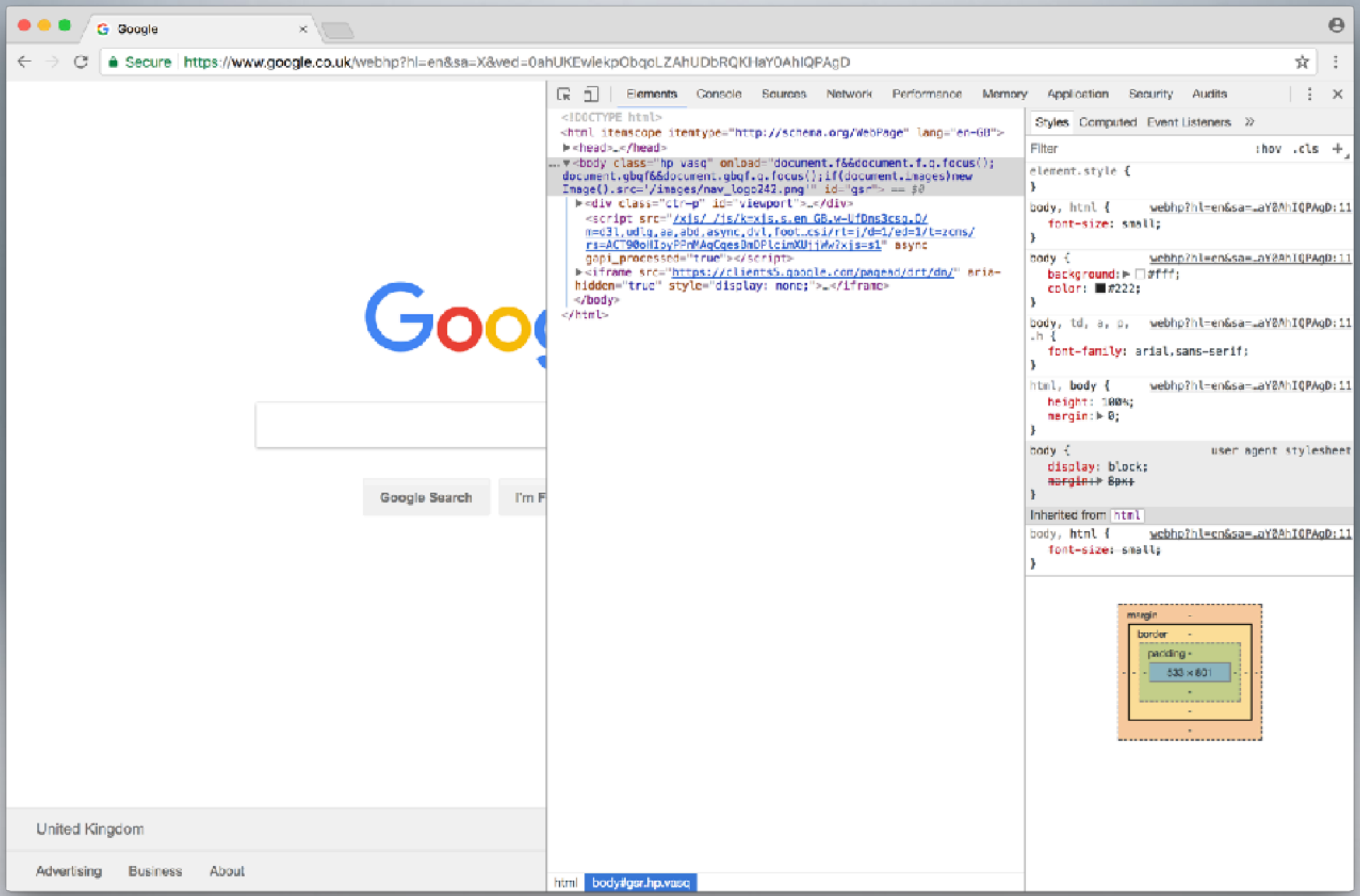
CHROME DEVELOPER TOOLS

- (Currently) Very popular - also pioneers new ideas & directions for the future of the web



- Fast. Stable, Feature Rich. Many tools to support developers - get access to the surface (the web page) but also the internals of the browser & the web page/application

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<!DOCTYPE html>
<html itemscope itemtype="http://schema.org/WebPage" lang="en-GB">
<head>…</head>
<body class="hp vasq" onload="document.f&&document.f.q.focus();document.gbqf&&document.gbqf.q.focus();if(document.images)new Image().src='/images/nav_logo242.png'" id="gsr">
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<script src="/xjs/_/js/k=xjs.s.en_GB.w-UfDns3csg.O/m=d3l,udlg,ae,abd,async,dvl,foot_csi/rt=j/d=1/ed=1/t=zcms/rs=ACT90oHIoyPPnMAqCqesDmDPlcimXUjjWw?xjs=s1" async gapi_processed="true"></script>
<iframe src="https://clients6.google.com/pagead/drt/dn/" aria-hidden="true" style="display: none;">…</iframe>
</body>
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color: #222;
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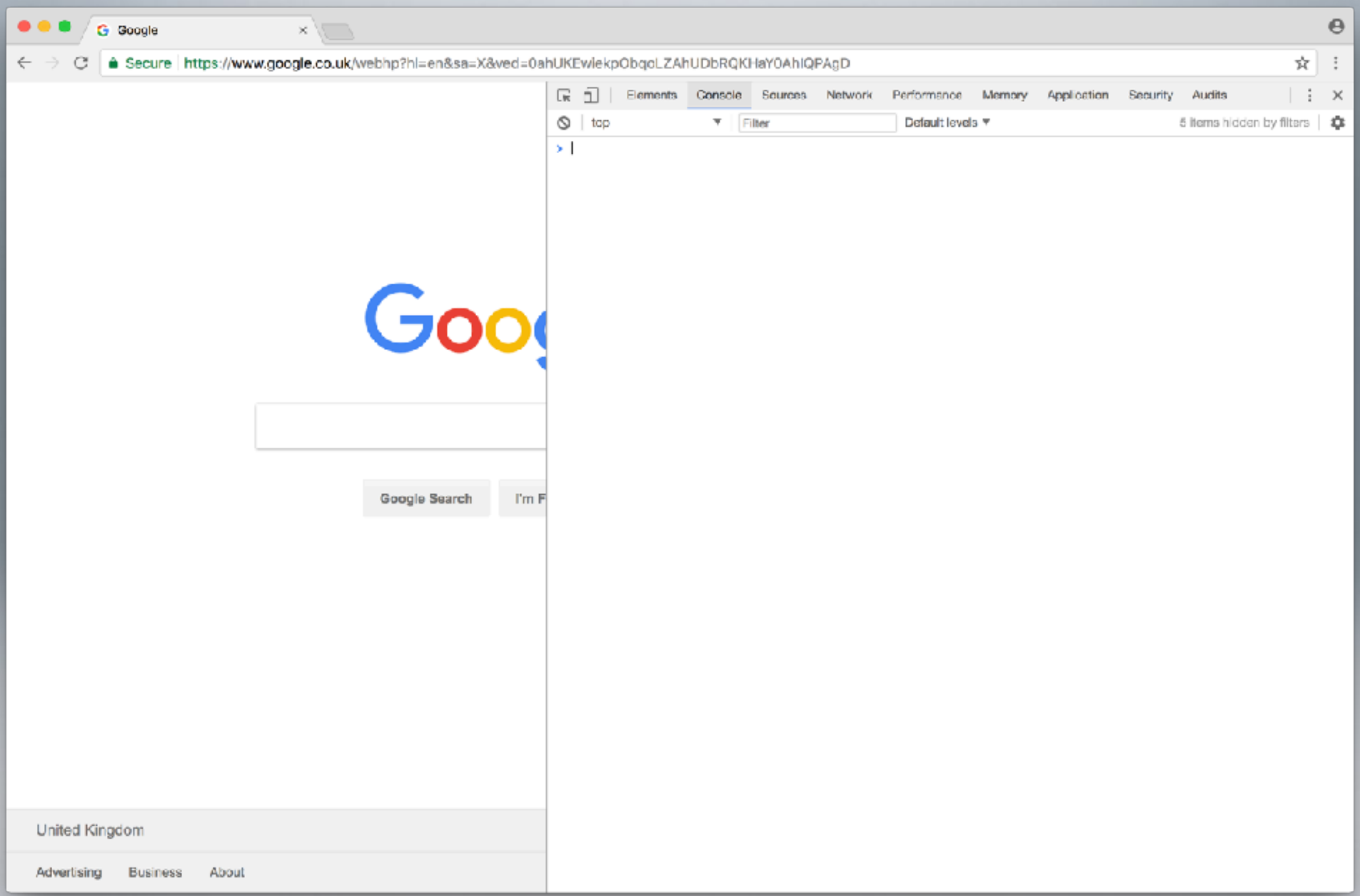
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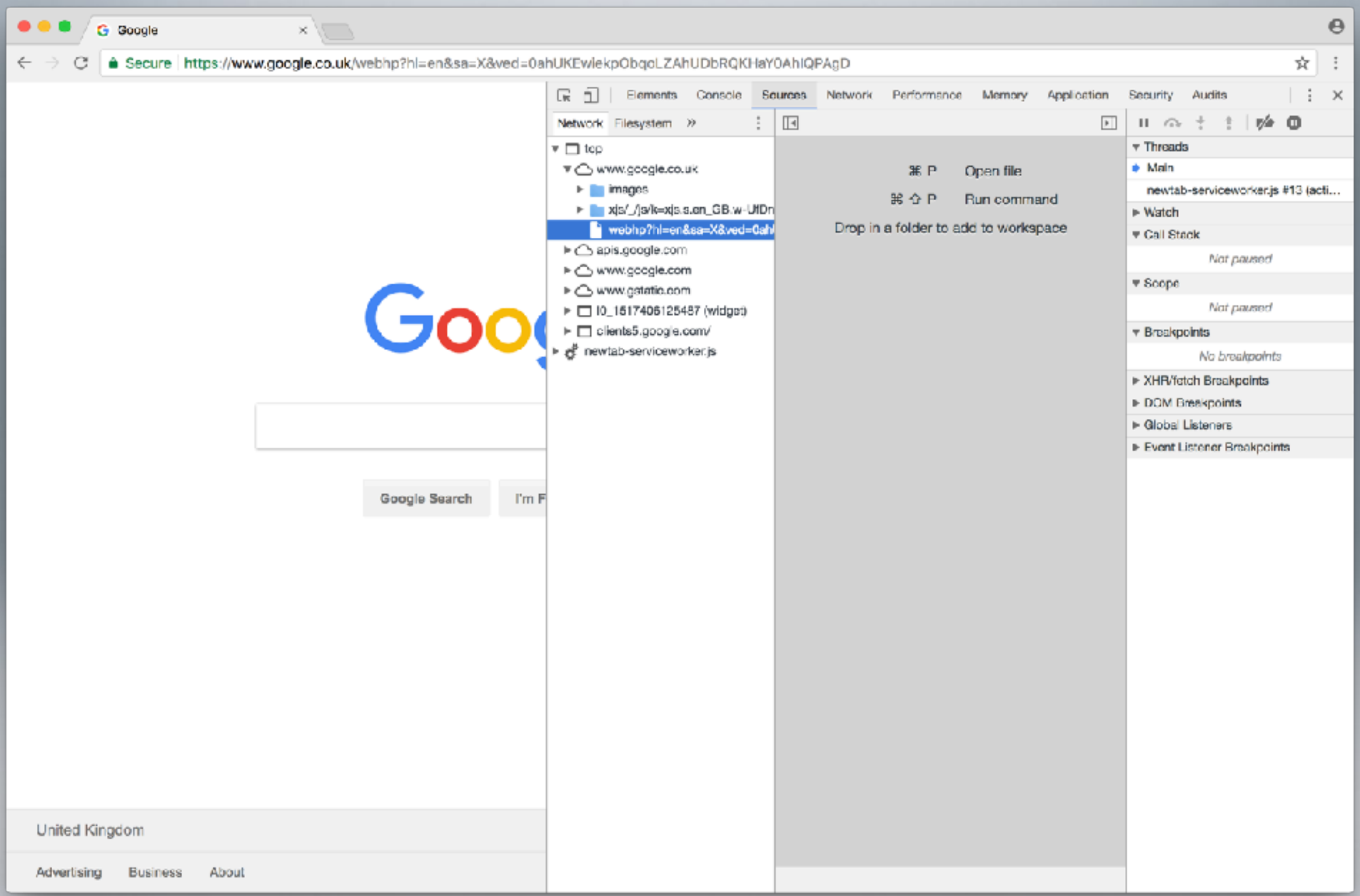
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⌘ ⇧ P Run command
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Scope
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Global Listeners
Event Listener Breakpoints
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View: Group by frame Preserve log Disable cache Offline Online

Filter Hide data URLs All XHR JS CSS Img Media Font Doc WS Manifest Other

10 ms 20 ms 30 ms 40 ms 50 ms 60 ms 70 ms 80 ms 90 ms 100 ms 110

Name	Status	Type	Initiator	Size	Time	Waterfall	4.00 s	6.00
googlelogo_color_272x92dp.png	200	png	webhp?hl=en&s...	(from di...	30 ms			
data:image/gif;base...	200	gif	webhp?hl=en&s...	(from m...	0 ms			
gen_204?s=webaft&atyp=csi&ei=...	204	text/html	webhp?hl=en&s...	40 B	51 ms			
nav_logo242.png	200	png	webhp?hl=en&s...	(from m...	0 ms			
rs=ACT90oHIpyPPnMAgCgesBm...	200	script	webhp?hl=en&s...	(from di...	9 ms			
tia.png	200	png	rs=ACT90oHIpy...	(from m...	0 ms			
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data:image/gif;base...	200	gif	rs=ACT90oHIpy...	(from m...	0 ms			
rs=ACT90oHIpyPPnMAgCgesBm...	200	script	rs=ACT90oHIpy...	31.6 KB	110 ms			
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rs=AA2YrTuYBNXI2WfsWOZ7Bw...	200	script	webhp?hl=en&s...	(from di...	6 ms			
cb	200	document	rs=AA2YrTuYBN...	140 B	73 ms			
cb=gapi.loaded_0	200	script	rs=AA2YrTuYBN...	(from di...	50 ms			
count	200	xhr	rs=AA2YrTuYBN...	535 B	239 ms			
gen_204?atyp=csi&ei=p8dxWvXy...	204	text/html	rs=ACT90oHIpy...	38 B	96 ms			
ui	204	text/html	rs=ACT90oHIpy...	43 B	92 ms			
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widget?sourceid=1&hl=en&origin...	200	document	cb=gapi.loaded...	229 KB	8 ms			
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rs=AGLTcCNZF80mC5Rwal4mvp...	200	xhr	/_/scs/social-sta...	(from di...	11 ms			
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rs=AGLTcCNZF80mC5Rwal4mvp...	200	xhr	/_/scs/social-sta...	(from di...	28 ms			
rs=AGLTcCNZF80mC5Rwal4mvp...	200	xhr	/_/scs/social-sta...	(from di...	20 ms			
cb=gapi.loaded_0	200	script	api.js:7	(from di...	8 ms			

30 requests | 477 KB transferred | Finish: 5.86 s

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Screenshots Memory

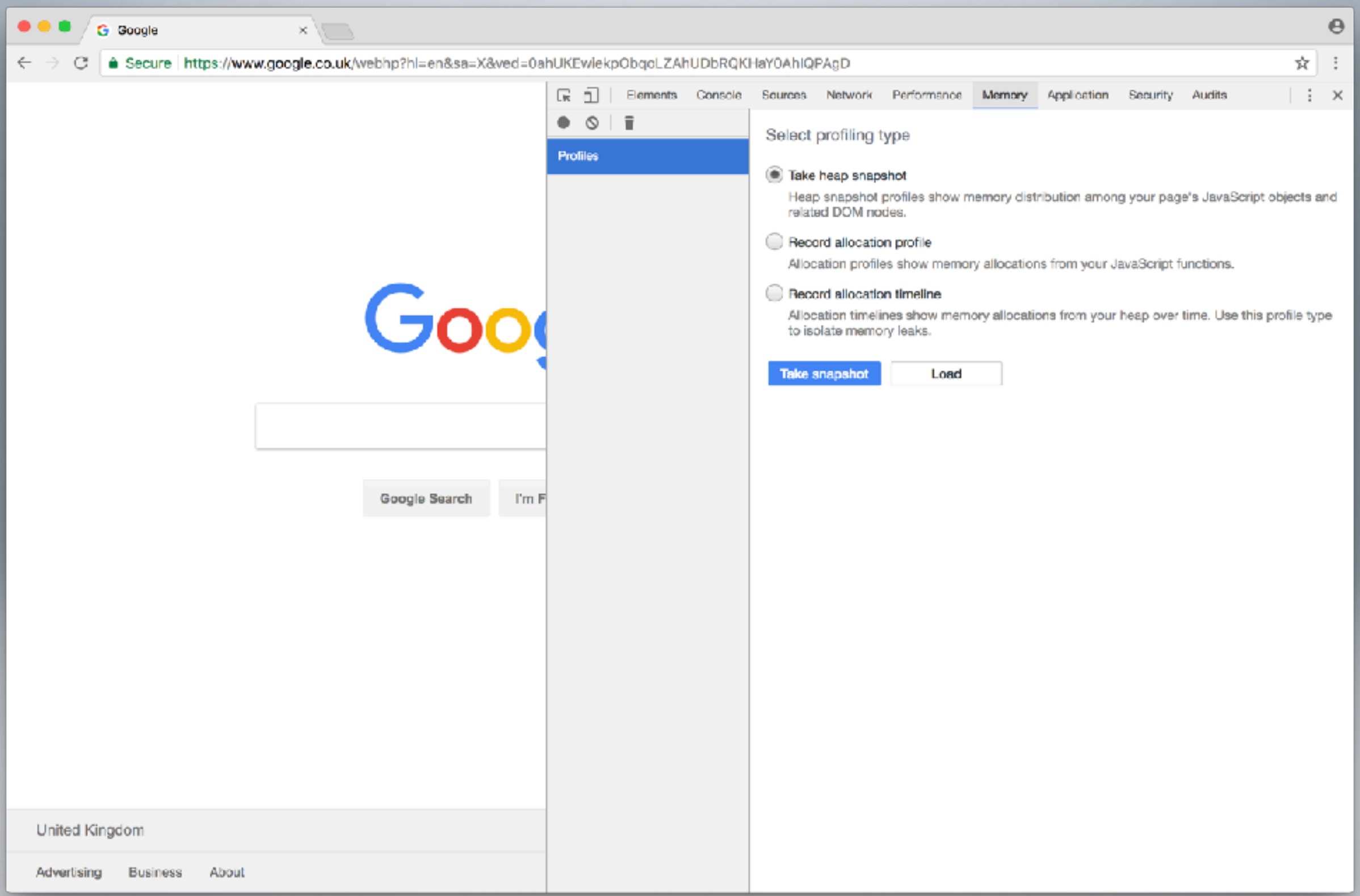
Click the record button ● or hit ⌘ E to start a new recording.

Click the reload button ↻ or hit ⌘ ⇧ E to record the page load.

After recording, select an area of interest in the overview by dragging.
Then, zoom and pan the timeline with the mousewheel or **WASD** keys.
Learn more

The **Performance** panel provides the combined functionality of Timeline and JavaScript CPU profiler. Learn more

The JavaScript CPU profiler will be removed shortly. Meanwhile, it's available under ⋮ → More Tools → JavaScript Profiler.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Profiles
Select profiling type
Take heap snapshot
Heap snapshot profiles show memory distribution among your page's JavaScript objects and related DOM nodes.
Record allocation profile
Allocation profiles show memory allocations from your JavaScript functions.
Record allocation timeline
Allocation timelines show memory allocations from your heap over time. Use this profile type to isolate memory leaks.
Take snapshot
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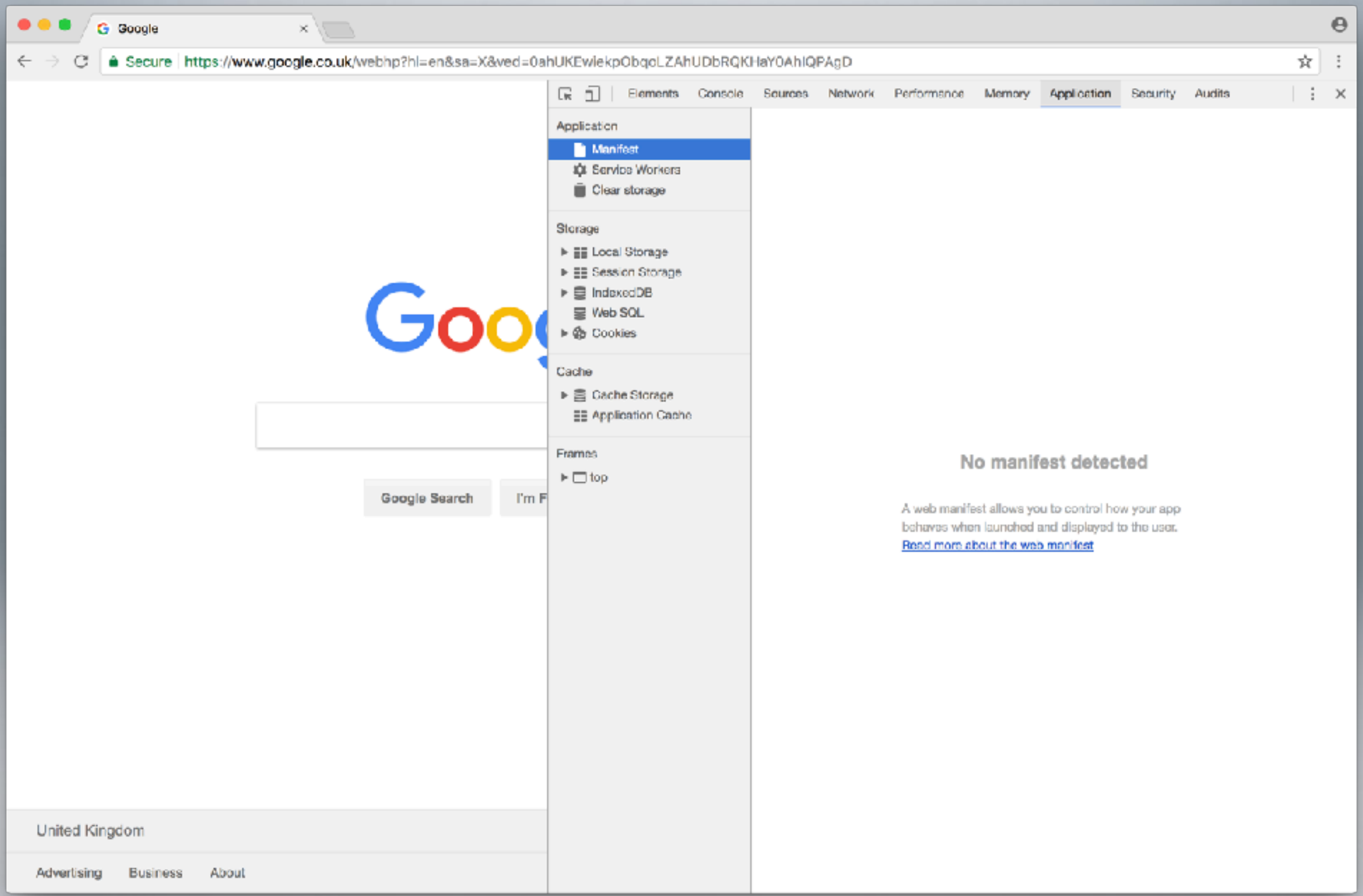
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Local Storage
Session Storage
IndexedDB
Web SQL
Cookies
Cache
Cache Storage
Application Cache
Frames
top
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No manifest detected
A web manifest allows you to control how your app behaves when launched and displayed to the user.
Read more about the web manifest

Google

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Overview

Main origin

Reload to view details

Security overview

This page is secure (valid HTTPS).

Valid certificate

The connection to this site is using a valid, trusted server certificate issued by Google Internet Authority G2.

View certificate

Secure connection

The connection to this site is encrypted and authenticated using QUIC (a strong protocol), X25519 (a strong key exchange), and AES_128_GCM (a strong cipher).

Secure resources

All resources on this page are served securely.

Google

Secure https://www.google.co.uk/webhp?hl=en&sa=X&ved=0ahUKEwiekpObqoLZAhUDbRQKHaY0AhIQPAgD

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Audits help you identify and fix common problems that affect your site's performance, accessibility, and user experience. Learn more

Perform an audit...

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SUMMARY

- Before we can go anywhere, we should really know how we got here.
- A potted history of the Internet, Web, Hypertext, DOM, & Basic Web Architecture (Servers & Clients)
- What happened technologically & socially, that lead to the situation we are in now?
- Overview of the basic things we need to know to understand how it all fits together

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NEXT

- The wonderful world of text markup, Hypertext, and HTML
- or "how to structure our data for the web"